Irrigation scheduling, water pollution monitoring in IoT: A Review

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Abstract

Internet of things (IoT) also called internet of everything (IoE) are network of physical object having connectivity with the internet. IoT is broad field with several new and advanced trends which made more suitable to implement and connect over the remote areas. IoT became more suitable platform in several applications with the emergence of the other field. IoT provide fast solution of the several real life problems with integration of the new trends and techniques. The field of automation is need of this era with other smart and advanced features bought up with new way of the handling the problems. IoT is the concept which can be applied globally over the networks of the things for solving the problem of the manual control especially in remote applications. This study reviews important aspects of water irrigation in IoT. However, it covers the challenges, applications and water pollution.

Keywords: Water irrigation. Water pollution. IoT

Introduction

Internet of things (IoT)

Internet of things (IoT) also called internet of everything (IoE) are network of physical object having connectivity with the internet. IoT is broad field with several new and advanced trends which made more suitable to implement and connect over the remote areas. IoT became more suitable platform in several applications with the emergence of the other field. IoT provide fast solution of the several real life problems with integration of the new trends and techniques. The field of automation is need of this era with other smart and advanced features bought up with new way of the handling the problems. IoT is the concept which can be applied globally over the networks of the things for solving the problem of the manual control especially in remote applications [1]. The connectivity of the objects with internet provides auto control of the devices with the implementation of the microcontroller technology and smart sensors and actuators it makes a network with several auto featured environment. The cloud, sensors, actuators and battery life are the important constraint of the IoT network which makes smart connectivity [2]. The processing power is also one of the crucial parts of the IoT and due to limited energy it has limited capability of working. In IOT many heritage frequency system are used to communicate over long distance [3]. As for as IOT research community focused on the low power communication devices with limited battery life. In this regard most of the internet of things device needs more efficient frequency, power and battery life management in order to work more efficient way among the network of things. The short distance communication may deal with low powered devices with efficiency of the data delivery. Lora is about physical layer to cover up the long distance communication. Most of the wireless systems are using

frequency shifting keying policies over a long communication range for the distance communication as the physical layer due the efficiency for achieving low power. Whereas LoRa is based on the Chirp spread spectrum modulation which maintains the low power characteristics with the better and increases in communication range. In this paper applications of IOT related with LoRaWAN, software and hardware technologies are discussed in detailed**.**

Objective

The focus study is to achieve the following objective the improvement water management problem in Sindh. The study covers Applications of IoT in agricultural irrigation and problems in Pakistan agricultural irrigation. However the important IoT trends are discussed for improvement of irrigation scheduling and efficient water pouring. The IoT Module for smart irrigation is proposed for better soil water requirement.

Motivation of Article

Agriculture is considered backbone of economy of any country. The quality and quantity of the agricultural products are very important due to lots of the environmental pollution including water pollution, toxic spray and other poisonous waste material in the field. The world is changing the way of agricultural production with implementation of latest technology and smart devices in the fields with real time monitoring. The IoT (internet of things) with smart enabling technologies brought revolution in the agricultural production. IoT and WSN brought rapid and efficient methods of the cultivation; monitoring and smart irrigation can bring lots of improvement in agriculture crops. Crop Production and IoT now became most hot interest of researchers in these days. The implementation of the smart devices in the fields for the real time monitoring of the crops are very attractive and having positive effects on the agricultural production. In this regard IoT and WSN become most important part of the research related to the smart farming and automated irrigation control. The IoT devices which includes the sensors, smart microcontrollers with integration of actuators may easily implement in the fields and can obtained more positive results of the crop production as never achieved before. The statistics of the agricultural field can easily be collected with real time monitoring by applying the fission of the sensors such as temperature, humidity and soil etc.

In Pakistan the agricultural fields are very vast and having very old way of the agricultural monitoring such as checking the borders of the fields for water

leakage, spraying the plants with manual methods, checking of water in the fields either it is properly poured or not? . These practices in other eastern countries are very smart with the implementation of the IoT and enabling technologies and caused greater impact on the agricultural production. Whereas in Pakistan it is very critical situation specially water wastage and water control in the agricultural fields. The automation of the water control with the real time monitoring can be deployed in agricultural fields with implementation of the IoT and WSN smart framework which is basically aim of this research. Due to the old method of water pouring and monitoring of the water in the fields it causes the time wastage, resources consuming and water wastage. The pouring of water without the checking of the water quality is also important factor for the agricultural production. This can directly affect the crop production. In this regard checking the water quality by the implementation of the smart framework may easily give the status of the water such as mettle and solvents in the water from the industries in rivers and canals can damage the pureness of the water. So by the implementation of the water checking Smart IoT framework is necessary in Pakistan.

In Pakistan old method of water pouring in the field causes the water wastage so it is important to monitor the water in the fields with appropriate implementation of the IoT framework with the sensors such as soil monitoring and water level in the field. This will led to check the water requirement and water level in the field. Whereas soil monitoring is important for the checking of the soil status for the particular days especially in summer. The timing of the water pouring which is needed to pour water in the particular region is necessary to record which will show the time of water pouring in the field. The implementation the IoT framework will also show the time scale of the water pouring in the particular region i-e acre.

The consumption of water in the particular region is necessary to measure for the future predictions in Pakistan it not easy to measure the water consumption in the agricultural fields. The implementation of IoT framework can easily measure the water consumption in the particular region. The idea behind to measure the water consumption in the field can led the water saving with smart monitoring of water using IoT and other emerging technologies.

Pakistan and irrigation problems

Agricultural industry has been one of the backbones of the world's economy. Most of the countries of the world depend on agriculture and having greater part of wealth. The Asian regions mostly depend on the agriculture including Pakistan. Agriculture is important economical factor of Pakistan. The major production of goods and food products are based on the agricultural products. The raw material for the food and other important energy constrains are provided by the agricultural industry. This led rapid growth to modern trends of the agricultural production and water management techniques. The new technology of computer science called IoT brought revolutionary enhancement in agricultural production and introduced very effective methods of agricultural monitoring with real time applications.

A water crisis in Pakistan is one of the major area of study in the production of agriculture. The number resources can be generated for the water quality and flow of the water for the cultivation of the crops. Mainly in Pakistan three ways of water is used in irrigation surface water, rain water and ground water. In surface water includes river, streams, open canal and impounded water whereas in ground water includes ground wells and rain water includes locally collected water such as cisterns and rain barrels. For agricultural usage, water needs to be provided most efficient way. This includes several problems for the deployment of water for each area. The agricultural area where different types of crops are produced needs to be provided proper water management. The water qualities in the fields have greater impact on the agricultural crop production. The water quality in Pakistan is very critical issue for the agricultural fields. The polluted water in the agriculture field may produce poisonous product which is dangerous for the human health. So it is important to focus the water pollution in agricultural field. The wastage of water is also important factor in crop production which can be the cause of the secrecy of water. In Pakistan this may cause of any whole under the surface of the land and can cause the water wastage. Bulk quantity of water wastage and the area where fields is empty, the area where water is not needed in the fields is big cause of water

wastage. The proper water arrival in the crop fields is also important factor. The access of water will be the cause of fungus in plants, effects the plants growth and other impairments in crop production. In Pakistan the traditional method of the water pouring in the fields is very critical and monitoring of the water is time consuming and out of control in the fields. So automated water management framework is needed to be implemented in the fields for the water saving and for the checking of the proper water arrival in the fields. The proper requirement of the water is also important for the crop production. The water should arrive in the filed adequately otherwise the plant which is out of reach may directly affect. The focus of study is also to overcome the above problems with the implementation of the IoT smart network which give smart automated water management. The smart network will be implemented in such a way that will improve the productivity, water deployment, water monitoring and the proper water management.

IoT in agricultural irrigation

The trend of the automated controlled systems is crucial part of the research and innovation. Auto controlled applications in real life are increasing day by day. Agriculture industry is one of the most important sources of human survival. Agricultural products are key source of income in the world [4]. Technological revolution in agricultural field brought so many new trends and techniques in agricultural. Wireless sensor technology and IoT made so many new smart applications with respective to the agricultural field based problem which are difficult to manage and control by the old traditional method. The field of automation industry brought lot of changes and way of the cultivating, harvesting, seeding and irrigation other important aspects. The automation in the life by implementing the latest techniques in agricultural crop field can improve the product as well as time and cost of the former. The IoT and sensor technology can sense and control activities of agriculture land. There are so many important factors which can decrease the agricultural product to great extent such as water secrecy, water pollution, soil nitrogen deficiency, and Soil low pH level. Climate based parameters such as temperature, humidity, solar radiation, wind speed, air temperature and heat index are also important to encounter for the efficient crop production. Hence agricultural automation may decrease the risk factor of the agriculture disease prediction, crop status, water soil status updating and other important parameters which are important part of the agricultural filed. The IoT and Emerging technologies are discussed below in detail:

IoT Applications in precision Agricultural

IoT is important stockholder of the industry due to reliability, efficiency and smart working principle. Emerging technologies such as sensor, microcontroller, and actuator [5] made easy and convenient to measure, upload and apply computer methods for better results. IoT framework can sense the data from environment with implementation of sensors and performs actions with the help of actuators by sensed data. Micro-controller technology made simple and efficient measurement of activities in agriculture crop areas which were impossible ever before one decade. IoT covers many fields of interest and having very strong applications areas whereas the focus of the work is agriculture. IoT is one of the vast fields of research and covers almost all fields of life. In this perspective it is often called emerging technology due to open frame work and having the emergence of the different technologies such as WSN, AI and big data. Deployment of the sensors is easy way to measure different parameters one time reading. Real time parameters for the improvement of the agricultural crop product and rapid awareness of air, water and soil parameters. Important applications in precision agriculture farming are given below:

Real time monitoring

Monitoring agricultural fields are very time consuming and also having lack of accurate field monitoring. Most often traditional methods is followed by the stockholders on the basis of human guess and prediction which is not accurate. The sensitive parameters in agricultural fields should be monitored time by time with up to date information. Plant disease is important factor which effect on crop leafs as well as plant growth. Other factors such as soil monitoring, temperature and water IoT made easy to monitor and calculate

the area of agricultural farming. The agriculture product automation harvesting control suing the IoT technology is one of the interesting aspect of the IoT smart frame work. The automated calculation of the products samples and having the quality measure features can easily be implemented by the help of the smart monitoring of the precision agriculture frame work [6]. The harvesting in fields are very critical for the IoT based agent like robot. These Robots can work efficiently with implementation of sensor based technology and actuators for the moving and performing the harvesting tasks. For this number of sensors are needed to implement such as temperature, humidity, human detectors, locomotion etc. All these sensors with the implementation of actuators makes a strong and efficient IoT based smart automated robot. Agriculture automated harvesting needs lot of parameters to consider in account such as the area of fields, distance range among the area where seed is planted, the obstacle detector which detects the obstacle in the field etc. These important parameters can be covered with the implantation of the IoT technology.

Smart irrigation control

Water supply regulation and controlling water usage in agricultural field is very important area of research. Time management of water pouring in field is very important for soil this gives need of IoT to give automated status of soil. Soil update and water level measuring is important for automated water supply management. IoT given a method of smart agricultural field monitoring to check agricultural area is completely poured. Implementation of smart IoT framework can enhance capability of agricultural field monitoring better than traditional methods. Polluted water is big issue in Pakistan especially for agricultural crop. Water quality also can easily be measured by implementation of water quality sensors that measure water pollution.

Agriculture Warehouse Monitoring

In agriculture water monitoring IoT brought concept of smart ware house monitoring. IoT enhanced capability with very rapid and fast threat detection. Agricultural warehouse can be monitored real time with implementation of human detector sensors, temperature status of warehouse by temperature sensors and other important parameters related to staff monitoring and owner awareness related to warehouse status [7]. This can be achieved by implementation of IoT devices with cloud connectivity and having proper updating mechanism for owner. Anything any time can be connected and monitored with real time update.

Soil Monitoring

Soil is key component for agricultural crops. Monitoring soil IoT made easy to control and coordinate the changes in soil. To monitor Nitrogen (N), Co2 and other important constraint monitor and get update over the cloud with real time monitoring. Strong recommendation system can be designed for betterment of soil fertilization .

Literate Review

In agricultural field researchers focus is to make more simple and smart methods of agricultural crops productions. In this regard IoT, WSN and other emerging fields are most important focus of study. Researchers are focusing on these fields and introduced several new trends and techniques for agricultural automation industry. Automation industry is now seeking new opportunity in field of agriculture and livestock. Agricultural crop diseases diagnoses become easy with several soil monitoring techniques which are crucial part of researchers' focus. Big data and WSN are also research areas which can be implemented with IoT tools and techniques.

Robot based model designed in which work in the field and perform several task automatically. In their study a remote GPS based robot system has been introduced which is capable to work in the remote places. This led to the several operations with automated task a robot can perform in the field like weeding, spraying, Soil monitoring and moisture monitoring etc. the second part of the work is to control the automated irrigation system is introduced in their study on the bases of real time data statistics of soil. In their study they have also focused on the data ware house management and auto monitoring of the warehouse.

The important parameters are further monitored such as temperature, humidity and theft detection in the premises of the agricultural warehouse. This study has many new areas where number of things can be focused for further research. Another study is has been engaged in the focus of study is to measure the soil status with respect to the environmental conditions. IoT technology is used to monitor the real time condition of the citrus soil moisture. The other area of focus in their work is to manage and control the fertilizer access in the field. The study also suggests the smart irrigation system which can control and manage with the automated operation without any intervention. The study in author focus of study is in agricultural soil monitoring with the effective usage of the soil monitoring using the soil sensor. Soil sensors are deployed in the field for monitoring of agricultural soil status. The objective of that study is to enhance the quality of soil and improve the crops production. The concept of remote monitoring is focused in this study for the evaluation and monitoring of the soil. Smart irrigation control is focused in where a smart module of the Wi-Fi Kit is deployed for the internet connectivity to upload and connect the IoT kit with internet. In their work numbers of sensors are deployed in the field where all the sensors are connected with smart microcontroller. After connectivity the data is uploaded over an android application for the updating the status of agricultural soil which is obtained from the soil and temperature sensors. A study on the cloud computing and Internet of things is focused in is published. In which author has used combine technology of IoT and cloud computing. The focus of study to motivate the farmer on the basis of the automation techniques which actually needed to implement in the real field environment. Further the RFID technology with integration of the IoT techniques can help to control and co-ordinate the activities of the agricultural field crops. The real implementation of the IoT technology can improve the field automation of the agricultural area which can help to monitor over all activities of agricultural crops. IoT technology managing the smart farming with auto-controlled. In their studies which provide the smart collection of the statistics related to the agricultural field. Another study in they focused on the monitoring the major factors of the crop yield efficiency. In their study they have also focused on the temperature and humidity measurement with the implementation of the sensors and single chip which provides the best smart monitoring. For the further related work they have included camera for captures image. The study in (Abbasi, Islam, Shaikh, & others, 2014) focused on the humidity measurement using IoT technology with the implementation of the humidity sensors. They focused on the environmental factors related to the humidity and the effect of the humidity on the agricultural crops. The studies in agricultural applications in sensor network using the WSN technology are focused. The numbers of regional and international parameters are surveyed. The numbers of identified challenges are focused and their solutions and prospects are studied in detail. They main objective was to focus the problems of the agricultural IoT related to the WSN approaches. The technical issues in irrigation system sing IoT are discussed in. The main objective of the study was to focus the cloud IoT using the source data with several data analytics techniques with potential solutions. Agricultural sensor monitoring survey is studded in with the additional feature of the cloud computing. The number of parameters are focused in such as temperature, humidity, soil monitoring, water level and soil nutrition are included in the study. The new idea of the agricultural monitoring with cloud computing techniques which gives an impressive way of the machine learning. Automated irrigation control with the same approach is also discussed in. The study also focused on the implementation of the IoT and WSN technology for the monitoring of the water stress in the pipe, water need in the agricultural field with the water arrival of the each and every part of the crops. The automated irrigations system is purposed in which based on the soil humidity. The humidity monitoring is monitored with the implementation of the humidity sensor. The solid update is updated over a server which is able to maintain the database of the sensor readings on the basis of reading a microcontroller drives the solenoid valve. The update is updated over on local computer for this java platform is used for the getting serial communication update. The soil pH level is also recorded for the updating of the soil status and update information is uploaded over the server. Another study purposed by in which the focus of work is IoT smart components with the integration of the several environmental parameters

with water irrigation monitoring. In their work they have given a smart model which is also able to detect the intruder if here is any interruption of theft in the field. An electronic motor is arranged for the irrigation systems which work on the regular automation and as well as manually controlled system. The study is very useful related to irrigation control with several parameters are also measured for the updating of the data. Where is this is not focused in Pakistan with the IoT technology implementation it can improve the water control with several water quality parameters. Pakistan agricultural areas where water quality is very poor can be very useful to measure the water salinity and water pollution which is major issue in Pakistan. The moisture updating based water irrigation system is proposed which is used to control the water pouring in agricultural field. The data communication is performed via the wireless communication using Xbee wireless communication module. The moisture monitoring with the drip irrigation concept has been introduced in this study with centralized control of the water irrigation system of the agricultural field. Whereas in Pakistan it is not focused still for the communication based Xbee for the water controlled system having centralized control of the water. The concept of the drip irrigation is also focused by which is very useful for the new researcher to focus the important parameters of the water control and flow of the water in agricultural field. Several sensors with several new parameters can control the water flow, water pressure and water salinity in the agricultural field. The study also focused on the Cloud IoT with the efficient management of the data which collected by different sensors and can be updated over the cloud. Cloud IoT network and with implementation of the cyber physical system can improve the smart and efficient field monitoring and update the data over cloud for the future use can give a useful track record of the irrigation system of the agricultural field. In Pakistan it is not in study of focus still where it is important need of this era. The study in this work is also focus for smart irrigation system. The water consumption in Pakistan is important issue which necessary to focus of the study.

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RFID technology with integration of the IoT techniques can help to control and co-ordinate the activities of the agricultural field crops. The real implementation of the IoT technolgy can improve the field automation of the agricultural area which can help to monitor over all activities of agricultural crops. R.N. Rao etal in [8] their work they studied related to the IoT technology managing the smart farming with auto-controlled. In their study which provide the smart collection of the statistics related to the agricultural field. Another study in they focused on the monitoring the major factors of the crop yield efficiency. In their study they have also focused on the temperature and humidity measurement with the implementation of the sensors and single chip which provides the best smart monitoring. For the further related work they have included camera for captures image. The study in focused on the humidity measurement using IoT technology with the implementation of the humidity sensors. They focused on the environmental factors related to the humidity and the effect of the humidity on the agricultural crops.

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Conclusion

The study is presented to highlight important aspects of irrigation in Pakistan. An efficient IoT model water measuring the water requirement and water scheduling is proposed to deliver for better irrigation water pouring in agricultural fields. The system is able to manage water leakage, water level and water pressure on the soil and as well as plant roots. Furthermore it has ability to monitor weather update and water pollution which is good to know about the agricultural plants in land.

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